NOTES, ABSTRACTS, AND REVIEWS.

FORECASTING MONSOON RAINFALL IN INDIA.

[Reprinted from *Nature*, London, August 4, 1923, p. 175.]

A memorandum regarding the probable amount of monsoon rainfall in 1923 was submitted in the early part of June to the Government of India by Mr. J. H. Field, officiating Director General of Observatories. For the purpose of a forecast of the monsoon, India is divided into five sections, and the several conditions which are favorable for the various sections are given, the conditions ranging over a large part of the globe and at different seasons of the year. It is noted that a marked feature of the weather in May was the comparative absence of temporary advances of the monsoon in the Arabian Sea, where the monsoon proper was behind time.

Details are given of the influencing conditions in different parts of the globe, and from these it is concluded that there would be some delay in the establishment of normal monsoon conditions within the Indian area, but it was estimated that the delay was not likely to be prolonged. With regard to the total amount of monsoon rainfall, it seemed that in the peninsula there should be a small excess, with a corresponding excess in Mysore and Malabar.

For northern India and Burma no forecast could be issued. Recent telegraphic communications from Bombay received in the middle and toward the end of July state that the agricultural outlook is now satisfactory over almost the whole of the Bombay Presidency, where enough, or more than enough, rain has fallen nearly everywhere. According to usual custom, a further monsoon forecast will be issued in August; past experience shows that the earlier forecast issued in June is usually, on the whole, the more successful.

SNOW SURVEYS ON RECLAMATION PROJECTS.

We note from the Reclamation Record for July, 1923, that Mr. Calvin Casteel, project manager of the Okanogan unit of the Reclamation Service, has made for the past six years what appears to have been a simple though effective survey of the snowfall available for run-off from West Fork of Salmon Creek, Wash. The article gives no details of the method used in determining the amount of probable run-off. It is inferred that a personal visit is made to the snow fields where the depth of snow and the proportion of the watershed covered are the factors used in estimating the probable run-off.

Since 1911 the Weather Bureau has been recommending the intensive method of snow surveying.

This method has been applied to several watersheds of relatively small extent [1] and has given satisfactory results.

It is hoped that in the interest of other project managers Mr. Casteel will supply further details of his method of determining the probable run-off from visual inspection of the snow cover on the watershed.—*A. J. H.*

THE AURORAL SPECTRUM AND THE UPPER STRATA OF THE ATMOSPHERE.

By L. VEGARD.

[Abstracted from *Philosophical Magazine*, July, 1923, pp. 193-211.]

The author, in considering recent observations of the auroral spectrum made at the Geophysical Institute of Tromsø together with those made earlier, concludes that most, if not all, of the spectral lines must be due to nitrogen. Of 35 lines measured, 29 may be ascribed definitely to nitrogen, but the remaining 6 offer some difficulties. Two of these are very probably due to nitrogen; the remaining four—of which one is the characteristic green line—can not be ascribed either to hydrogen, helium, or oxygen. An important result of these studies is the failure to find a trace of hydrogen or helium spectra in the high levels of the atmosphere where these two light elements are supposed to occur. Attempts in the laboratory to produce these spectra by means of cathode ray bombardment in mixtures of nitrogen ahd helium and nitrogen and oxygen were unsuccessful, and the conclusion reached was that the pressure of these two gases must be very much less than that of nitrogen in the region of auroral occurrence.

Various difficulties are propounded and discussed concerning the distribution of these light gases in the topmost region of the atmosphere, and the conclusion is reached that the hydrogen and helium layer does not exist. Moreover, the possible presence of a new gas (geocoronium) is dismissed. This lends to the belief that the green auroral line is due to nitrogen and that nitrogen exists to the very limit of the atmosphere.

It is found that the nitrogen pressure at a height of 400 kilometers under the assumption of a temperature of 220° A. is the same as that for 542 kilometers with an assumed temperature of 300° A. Both of these levels are within the region of auroral occurrence, hence the higher temperature demanded by the recent study of Lindemann and Dobson on meteors, (see abstract below), does not alter the conclusions concerning the extremely low nitrogen pressure. In order to produce the observed light intensity at those levels the density of electric radiation must be enormous; indeed, this leads to a value of radiation intensity so great that it could not occur. Therefore, in some way, the nitrogen pressure must be greater than that calculated.

Owing to the photoelectric effect of the sun's action upon the upper layers of the atmosphere, the author believes that a layer of positive ions must exist which would give the effect of increased density. Thus light gases such as helium and hydrogen when ionized would become so light as to fly into space, thus accounting for their absence in the spectrum. Further, the failure to produce the auroral lines in the laboratory is probably due to the inability to reproduce the high degree of positive ionization in the gas. This would solve the problem of Lindemann and Dobson, and make unnecessary the assumption of improbable temperatures in the high atmosphere.

A footnote, inserted in the proof, states that since preparing the manuscript for his article the author has found that the highly ionized upper layer of nitrogen can not exist in the form of a gas, but is probably produced by the charge being carried by crystals of nitrogen. This renders some modification of the mathematical considerations necessary—a matter that will be dealt with in a second paper.—*C. L. M.*

THE CHARACTERISTICS OF THE ATMOSPHERE UP TO 200 KILOMETERS AS INDICATED BY OBSERVATIONS OF METEORS.

By G. M. B. DOBSON.

[Abstr. from *Quart. Jour. Roy. Met. Soc.*, July, 1923, 49: 152-165, 6 figs.]

The increasing use of meteors in meteorology is a welcome development. Kites and balloons, during the past quarter century, have given us a fairly accurate

[1] Henry, A. J. The density of snow, Mo. WEATHER REV., March, 1917, 45; 102-107.

knowledge of the atmosphere up to 20 km. Beyond 25 or 30 km. we have little prospect of direct observations, but various luminous phenomena, especially meteors and auroras, offer excellent opportunities for making deductions. The body of observations of meteors, particularly as to velocities, heights of appearance and disappearance, lengths of paths, and luminosities, is sufficient to allow the computation of sizes of meteors, densities of the air traversed, and, with other aids, probable temperatures and compositions of the atmosphere to a height of 200 km. Most meteors seem to have a size of the order of 1 mm. in diameter. Yet at their speeds of from under 15 to over 100 km. per second they so compress the air in their paths that it is heated to a degree high enough (2,000–4,000 A) to volatize at least the surface material of the meteor and to render it highly luminous.

The density of the air required to produce this effect must be 10 to 100 or more times greater than that computed by assuming that the temperature above 20 km. is the same as at that height. At 100 km. meteors seem to indicate a density of 0.00000001 gm. per cc. [cf. 0.001293 gm./cc. at standard sea-level conditions]. This greater than assumed density must be largely owing to higher temperatures and, therefore, more expanded and elevated layers of air.

It seems probable that the temperatures observed in the stratosphere, about 220 A (163° F.) obtain up to a height of 50 km., while from 60 to 160 km. the temperatures are about 300 A (81° F.). Above 200 km. the temperature may again be 220 A. The warmth of the layer from, say, 60 to 160 km., is ascribed to an absorptive layer of ozone, formed, presumably, by the action of the ultra-violet light on such oxygen as is present in the upper portion of the atmosphere. The absorption of ultra-violet radiation here appears to be responsible for the fact that only one twenty-thousandth part of the ultra-violet (wave length 2,900 Ångströms), probably coming from the sun, reaches the earth's surface in clear weather.

The solar heat absorbed in the ozone layer is perhaps 5 per cent of the total reaching the outer atmosphere. There appears to be a marked change in temperature from winter to summer, with a corresponding higher air density, and therefore higher limits at which meteors disappear in summer than in winter. A similar seasonal change in the height of the aurora will be looked for. The presumption of a change in temperature between 50 and 60 km. is strengthened by the marked infrequency with which meteors cross from the warm into the cold layer without fading out and the occurrence of luminosity with meteors at apparently lower velocities in the lower part of the warm than in the upper part of the cold layer. Furthermore, the well-known occurrence of a zone of sound outside a zone of silence about a great explosion could be explained by the presence of a warm layer beginning at a height of about 60 km.

The meteor observations do not support an assumption of the predominance of hydrogen at the heights where meteors occur. As in the lower atmosphere, the air seems to be predominantly nitrogen up to 160 km. Above this some rather doubtful observations indicate the presence of a lighter gas, probably helium, if, as seems likely, hydrogen is negligible.—*C. F. B.*

EFFECT OF CLIMATIC CONDITIONS ON FRUIT TREES.[1]

By Prof. H. A. PHILLIPS.

Author's summary.

(1) While many factors, such as available food, abundant water supply, pruning, spraying, and tillage, contribute to successful orcharding, there is none of more relative importance than climatic conditions.

(2) Epochs in fruit-bearing trees are retarded in their development by an increase in altitude. According to the data the average retardation is one day for every 101 feet.

(3) The average rate retardation in the blooming period of fruit-bearing trees is 4.6 days for every degree of increase in latitude. The greatest retardation is through the Atlantic States, and the least through the Pacific States.

(4) Epochs are earlier westward, and the lines of full-bloom dates and the ripening dates travel in a northeast direction.

(5) In the Atlantic and the Mississippi sections the rate of retardation is not constant. This is explained by conditions affecting the rest period. From the thirty-sixth parallel southward in the Mississippi Valley and the thirty-eighth parallel southward in the Atlantic section there is very little difference in the time of the blooming period.

(6) There is much greater uniformity in the epochs in fruit-bearing trees through the Pacific States, due primarily to the influence of the prevailing westerly winds from the Pacific Ocean.

(7) The ripening dates along any section travel faster than the blooming dates.

(8) The general average range of full-bloom dates at any given place is about three weeks.

(9) The number of days for the development of the ripened fruit is greater in the Pacific section than in the Atlantic and the Mississippi sections. Also the number is greater in the southern part of the Atlantic and the Mississippi sections than in the northern part.

(10) The peach, wherever grown, appears to be more uniform in its development than the other fruits.[2]

WEATHER AND CORN WILT.

Corn wilt, known as Stewart's disease, has been found in a large number of States, both in the South and the North. In the fields where found the number of diseased plants has been usually less than 20 per cent, but as high as 100 per cent infection has occasionally been found among the earlier varieties.

Dr. F. V. Rand, pathologist, and Miss Lillian C. Cash, scientific assistant, United States Department of Agriculture, have conducted field studies of this disease in Maryland during three seasons. A short account of results was published in the *Journal of Agricultural Research*, Vol. XXI, No. 4, May, 1921.

Varietal influence was found to be considerable, the *earlier varieties being much more susceptible to the*

[1] Author's thesis: Effect of climatic conditions on fruit trees in relation to the blooming and the ripening dates and the length of the growing period.

[2] The same data used by Doctor Phillips were partially summarized and presented in maps and tabular form in "Graphical summary of seasonal work on farm crops," by O. E. Baker, C. F. Brooks, and R. G. Hainsworth in Department of Agriculture Yearbook, 1917.